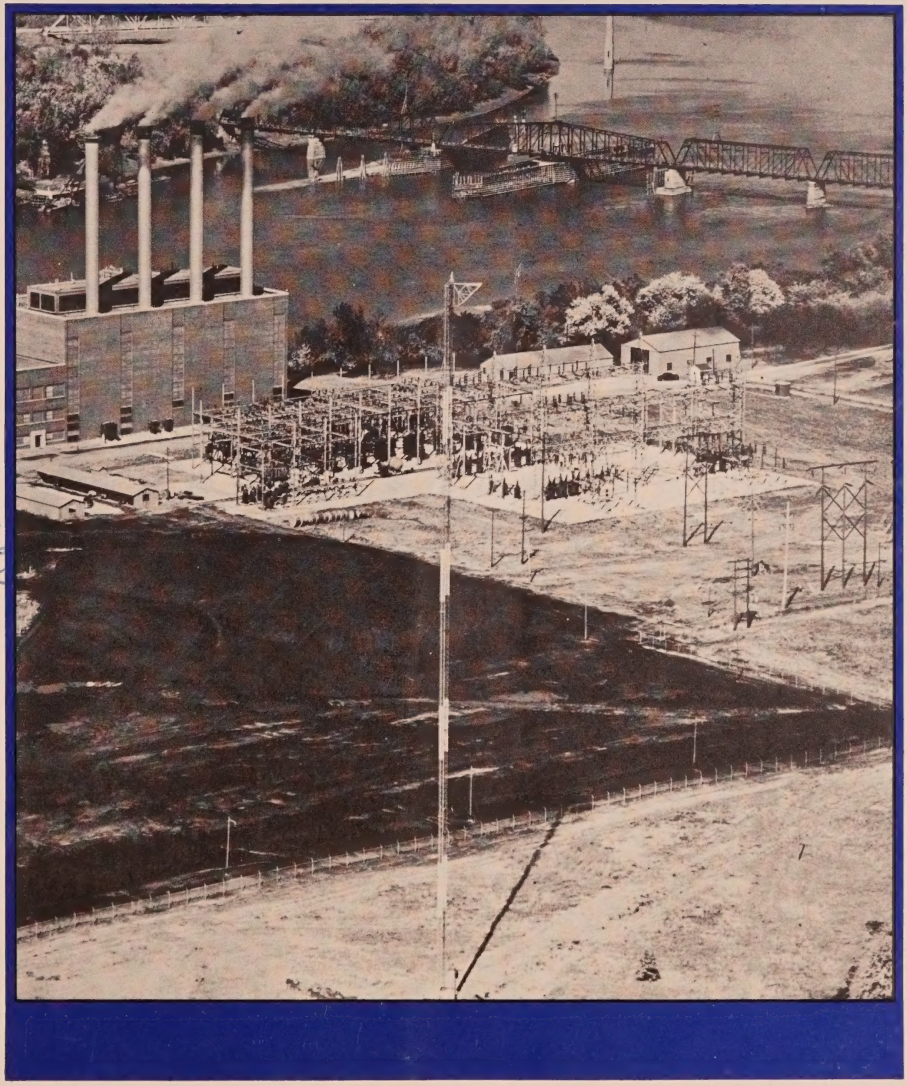
Communications & Electronics Division

Motorola NEWSGRAM

Nov-Dec, 1953



Power Utility Issue

BEYOND THE HORIZON

D. E. Noble

If you are not aware of the trend toward long distance VHF, UHF, and microwave communications, you will be interested in the comments I have to make. This long distance transmission over paths anywhere from 300 up to 1500 miles does not depend upon the usual refraction phenomenon, but is based upon the transmission of signal energy by a means which has been overlooked or neglected in the past. We are all familiar with the fact that the major portion of energy in the signals above 100 Mc. is transmitted over line-of sight paths, and beyond line-of-sight this signal level drops rapidly. Of course, we know from our observation of light that there is a certain amount of scattering or transmission of electro-magnetic energy around the curvature of the earth, but it was thought that the magnitude of the energy delivered in this way was too small to be useful for communications. Now it has been discovered that the signal levels possible through the use of this stray energy are great enough to provide uninterrupted communications over long distance paths utilizing frequencies formerly employed for line-of-sight communications only. In other words, it is entirely feasible to provide communications between two stations three hundred miles apart, using nothing more complicated than two properly designed 460 Mc. transmitters and receivers connected to a pair of efficient rhombic or other directional antenna systems. And even more important, the minimum signal level may be maintained high enough under all conditions to eliminate disruptions due to fading.

There is insufficient published data and information to indicate that the successful long distance transmissions beyond the horizon are understood in an exact quantitative sense. The theory will be developed later and, in the meantime, the experimental facts are so promising that we can expect to put beyond-the-horizon transmission to work almost immediately. This new approach to long distance communication was based upon the fact that, while the conventional formula for calculating a signal at a distant point would yield a negligible signal level, actual measurements show that the signal is much stronger, literally hundreds of db. stronger, than the value predicted by the classical theory. Since the attenuation is still high despite this favorable effect, high power is required for communications. The measurements show the received signal may be only 75 or 80 db. below the calculated free-space value. The equivalent high powers required are achieved through the use of directional antennas, and the power used at the transmitters may be anywhere from fifty to several hundred watts, depending upon the effectiveness of the antenna array used. Directional antennas must be used at both ends of the path.

Another point of great importance to us is the fact that this beyond-the-horizon transmission is independent in a practical sense of such things as the frequency, antenna height, and weather effects. You can use frequencies anywhere from 30 Mc. to 4000 Mc. There will come a day when microwave powers of 100 to 500 watts will be easy to obtain at reasonable cost and there will be wide application of long distance communication using single-hop microwave systems. The adaptation of this "new" transmission phenomenon to some of our point-to-point problems in state and county police systems is very promising. This may be a practical means for the reduction in the cost of building microwave systems where the path goes over inaccessible mountains. I wonder, too, if this does not offer the most promising solution for trans-Atlantic television hookups.

If any Motorola radio systems engineers are feeling ambitious and would like to establish communications between two stations two or three hundred miles apart, I suggest that the installation of high gain rhombics at each end of the path, connected to 250 watt transmitters working in the 30-50 Mc. band, would provide this beyond-the-horizon circuit. A set-up of this kind, associated with a coaxial switch, might make it possible to change from the normal coaxial antenna to the rhombic when long distance emergency transmission was required.

I should caution you that this is a frontier which has not been explored to any great extent, and much more information will be necessary before we can make use of it with confidence in widespread applications. There is no indication now that it will suddenly replace the present microwave relay technique. The relatively high power beam required, and the relatively low signal level which might be used, will introduce definite limitations in systems application.

Last Spring, at the North Atlantic States IRE Technical Meeting held at the University of Connecticut, I listened to a very interesting paper presented by Major Edwin Armstrong. He pointed out that, while the propagation experts evolved the neat array of theories to cover transmission phenomena, history showed that engineers and experimenters who didn't know any better went ahead and established communications outside of the realm of theory laid down by the experts. The Major is right. Experimental data frequently confounds the theorists. The development of theories covering short-wave transmission, tropospheric bending, and now beyond-the-horizon transmission, depends upon demonstrations of recalcitrant phenomena which ignore the known rules for well-behaved radio waves. We should never hesitate to go beyond the predictions of our nicely ordered scientific theories.

Read Kenneth Bullington's article in the January 1953 issue of IRE Proceedings for further information.

Dan Noble

The

Motorola Newsgram

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COVER PHOTO

Aerial view of Central Illinois Public Service Company's Meredosia Steam Generating Plant.

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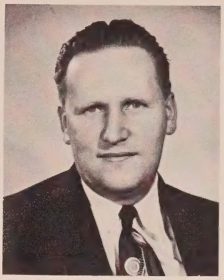


Henry Magnuski

Leonard G. Walker

NEW APPOINTMENTS

John P. Tansey has been nominated National Service Manager of the C. & E. Division by Vice President Daniel E. Noble to succeed Fred Schnell, now Staff Assistant to the National Marketing Manager. Mr. Tansey was previously Service Contract Manager of the National Service Organization.

Henry Magnuski has been appointed Associate Director of Research of the Communications and Electronics Division of Motorola, Inc. This promotion extends his responsibility to all departments in a technical consulting relationship. In the new position, he will retain his previous duties as Chief Engineer of the C. & E. Research Department.

Leonard G. Walker has been assigned the hybrid position of Power Utility Product Engineer and Product Manager. Walker is responsible for the engineering and marketing phases of power line carrier, audio carrier, supervisory control, coupling networks and other similar products in the "power utility" category. He was formerly Chief Systems Engineer for these equipments.

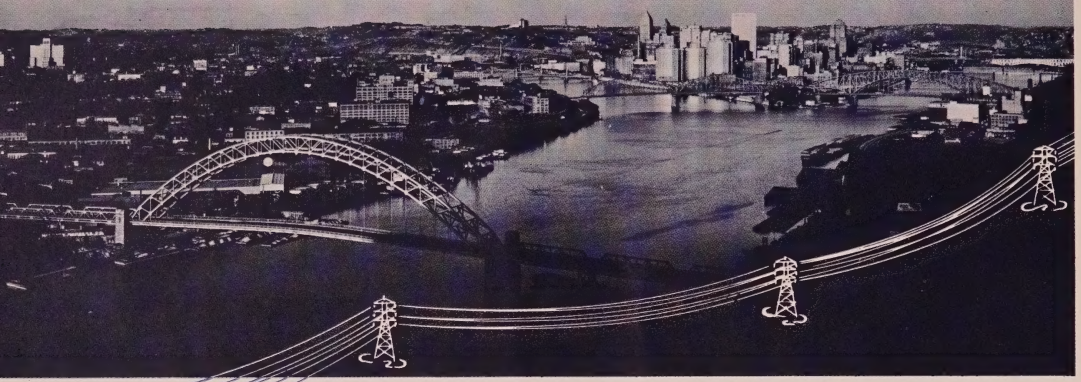
IRE GROUP MEETS AT BOSTON

The Boston section of the Institute of Radio Engineers was host to the National Professional Group on Vehicular Communications, IRE, in a convention at Boston's Hotel Somerset on November 12 and 13, 1953. P. R. Kendall, regional manager for Motorola Communications and Electronics, Inc., presided over this fourth annual meeting as Chairman of 1953 Annual Meeting Management.

The engineering papers presented included an address entitled, "Portable Equipment in the Communications System", delivered by William J. Weisz, Manager of Subminiature Equipment Engineering Section, Motorola, Inc. In his talk, he traced the development of portable 2-way radio from the first such unit, Motorola's famed wartime "Walkie-Talkie", to the present day "Handie-Talkie" radiophone. He also described the application of the portable equipment by the various industrial and public safety organizations.

Among others in attendance from Motorola were Eugene S. Goebel, National Sales Manager; Angus A. MacDonald, Chief Engineer; Frederick Hilton, Manager, VHF Transmitter Section and James Clark, Manager, VHF Receiver Section.

Power for the Golden Triangle



The triangle is generally assumed to be the geometric configuration most resistant to change. Not so the Golden Triangle of Pittsburgh where change and progress are the order of the day.

A cluster of silvery towers is replacing the smoke smudged jumble of brick that recently was Pittsburgh. Stainless steel and aluminum skyscrapers and new gracefully arching bridges are just part of an inspired construction program that is turning the highly industrialized eyesore into a city of beauty, one of the oldest, yet one of the most modern metropolitan areas in the nation.

The spirit of progress pervades the city. It has moved many individuals and many organizations, among them, the Duquesne Light Company, already renowned in the power industry as an enterprising concern. Duquesne Light has responded in characteristic fashion by embarking on a 200 million dollar expansion program to keep ahead of the constantly increasing demands for more power. And to insure that the construction program, and the never ending maintenance and servicing programs, too, are carried on with the highest attainable degree of efficiency, Duquesne Light has adopted that modern tool, two-way radio, and applied it perhaps more thoroughly and more effectively than any other power utility.

MANY CREWS

Power system maintenance, emergency service and construction require many crews of highly skilled men who use diversified, expensive equipment. More than a hundred trucks, each stocked with specialized gear and carrying from one to ten men are daily dispatched through the 800 square mile area to perform the many, many operations lumped under these three categories.

More efficient utilization of the abilities of these men and their tools was one of the prime factors in the decision of the company management to install an extensive Motorola two-way radio system. The men who made the decision reasoned that the crews and their tools represented a considerable investment. It followed that any waste of their time was prohibitively expensive. Without a completely adequate communication system, some waste of costly time was inevitable.

Before the radios were installed, the crews and the dispatcher were dependent upon the telephone for communication whenever the crew was out of the garage, and then, each interchange of information was of necessity initiated by a crew member. Quite often, the crew member had a hard time locating a telephone.

NO MORE STANDBY

Because the dispatcher could not reach the crews for reassignment, some had to be kept on standby in case of emergency. A crew on standby draws pay, but does no work. If no emergency occurs, its time is wasted.

When an emergency did occur, it was quite possible that the dispatched truck might travel miles to a point within two or three blocks of a similar truck capable of handling the situation, but beyond the reach of the dispatcher.

Still another consideration was manpower. In this era of full employment, skilled men are hard to find. Men working within a radio-coordinated system work more

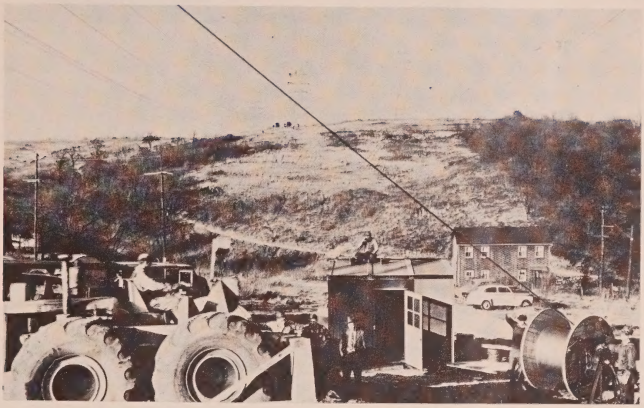
effectively. Four crews with radio do the work of five without.

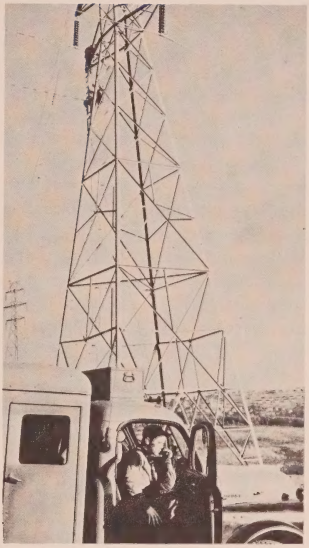
Another factor was the replacement of the telephone in city wide emergencies. In the past, during floods and other disasters, the telephone lines have been overloaded, a condition that slowed power system reconstruction tremendously. In the future, since power distribution and telephone service are both dependent upon exceedingly complex webs of wire, major disruptions in service due to enemy attack in wartime would tend to occur simultaneously in the two mediums. Thus, the Duquesne Light Company might lose its only means of communication. The loss of power to the community would consequently be extended, a condition that would magnify the effects of the disaster.

LINE STRINGING

Portable radio, too, is being used to advantage. For instance, in stringing transmission line towers, crews work on two or three consecutive towers simultaneously. If they were dependent on a messenger for communication, the operation would of necessity be halted from time to time with a consequent severe loss in man-hours. With the lightweight, portable "Handie-Talkie" units in use, messages are exchanged in a matter of seconds. No time is lost by the crews in waiting for a messenger to arrive.

By recognizing all these factors and acting to eliminate them, Duquesne Light has enhanced its reputation for foresightedness and ingenuity which originated years ago when company engineers designed and installed their own supervisory control system, one of the first in existence. Pittsburgh's progressive spirit is surely in evidence at Duquesne.





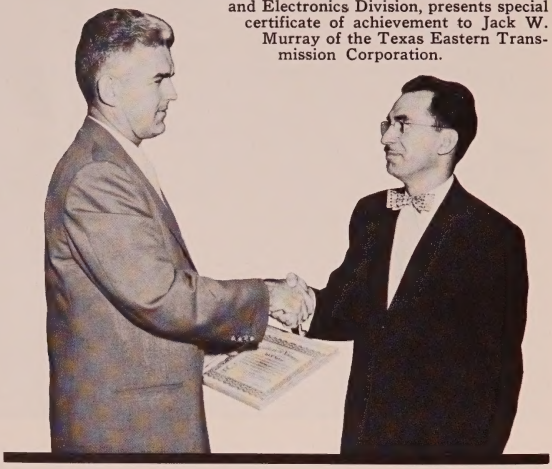
ABOVE: Every Duquesne Light Company truck is radio-equipped. When an unusual condition is encountered, it is a simple matter to call in for instructions, however remote the area.

UPPER LEFT: The line stringing crew in the background is well beyond shouting distance and about twenty minutes away by messenger. Radio saves time, cuts costs.

LOWER LEFT: The McKeesport dispatcher pulls a short line truck off a minor repair job to answer an emergency call two blocks away.

The A B C's of MICROWAVE

An Intensive Two-Week Training Course Taught By Motorola Systems Engineers Makes Microwave System Operation And Maintenance "Know-How" Available.



Arthur L. Reese (right), national marketing manager of Motorola's Communications and Electronics Division, presents special certificate of achievement to Jack W. Murray of the Texas Eastern Transmission Corporation.

The comprehensive Motorola microwave two-week training course is designed to teach those in attendance the operation and maintenance of Motorola microwave systems. To date, over 150 radio engineers and technicians have attended the school. City, county and federal governments, industries, utilities and telephone companies who are presently using or installing Motorola micowave systems have all been represented.

BACKGROUND

Until a little over five years ago, the possible use of microwaves as a media for voice communications, telemetering and supervisory control was known by relatively few people and those were all research engineers. Of these only a handful were fully acquainted with the actual operation of such a system. Since that time, the use of microwaves has been developed and refined to such an extent that today we find that it is a fully matured means of communication. So matured in fact that microwave systems are today more dependable than comparable wire line systems.

Because of this dependability and its relative inexpensiveness compared to functionally similar wire line systems, microwave towers today literally dot the countryside. Many pipeline companies, power utilities, law enforcement agencies, telephone companies, television stations and networks, and virtually every branch of industry have been quick to take advantage of this latest technological advance.

However, the number of technicians qualified to install, operate and maintain the microwave systems was very limited. Recognizing the need for more skilled maintenance personnel, Motorola held the first special microwave school a little over two years ago. The men who have attended the school have started the course with, in many cases, a background covering only basic radio theory. This knowledge was obtained from many sources including the operation of ham radio, FM 2-way radio, and power line carrier current equipment.

INSTRUCTION

The special, intensive two-week training course is under the direction of Arthur Kowitz, Motorola systems engineer. It consists of approximately 63 hours of lectures fully covering the individual chassis used in the microwave equipment plus round-table discussions covering an entire microwave system. Questions are freely asked at any time during the lectures.

In addition, between eight and ten hours are devoted to applying the information gained in the lectures to actual relay adjustment and equipment alignment of a working microwave system. Trouble-shooting with the aid of Motorola built test equipment is also an important part of this phase of the training course.

Wherever possible, conditions, which those attending the training course will find in the field are simulated.

Instruction and service manuals used in the field for maintaining a microwave system serve as textbooks for the school. These manuals cover the functions and adjustments peculiar to each individual chassis and describe how the chassis are used as building blocks for a microwave station.

System alignment, which is important because each station in a series is dependent on the preceding and succeeding stations, is covered completely in the course. Through an understanding of the entire system operation, a system fault can be located and corrected more easily.

It is easy for an uninformed technician to "over maintain" a microwave system. After the system has been installed, adjusted and checked, relatively little readjusting is necessary. Normal maintenance procedure consists of replacing tubes and checking the alignment of the various circuits. In most cases, "twiddling" knobs indiscriminately at any of the stations may result in sub-normal system performance. The built-in dependability of a microwave system is naturally contingent on proper maintenance, the same as any other electronic device. Of course, "over-maintaining" or "knob twiddling" will materially affect this. Techniques involved in localizing troubles are demonstrated in the school.

PRACTICAL

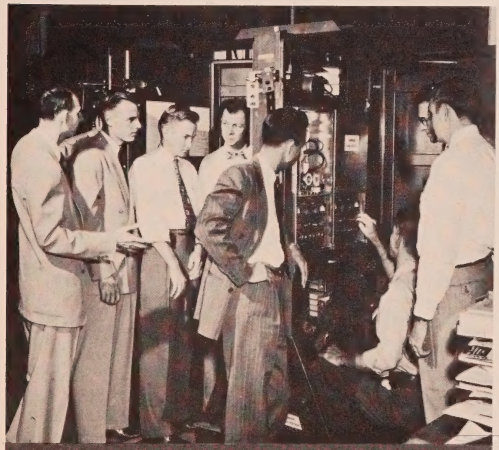
Every attempt is made to keep the course on a practical level and as free from high powered theory as possible. However where a theoretical discussion will give a clearer understanding of operational procedures, theory is used. For example some of the theory about the operation of a klystron oscillator is described so that tuning procedures may be more clearly understood.

The first week of the course is devoted to lectures covering microwave radio frequency equipment, while the second week covers sub-carrier, audio frequency carrier and test equipment plus actual system alignment and trouble-shooting. The rate at which the course progresses is, of course, determined to some extent by the questions which are asked. These will vary widely because of the divergent backgrounds of the men attending. Particular attention is paid in answering all questions fully so that each man will have the information under discussion crystal clear in his mind.

This is a particularly valuable feature of the training school since most of the men will be concerned with more than just microwave when they return to the field.

Microwave is more easily understood if considered as a marriage of well known radio engineering techniques to certain specialized developments. The subject is approached with this idea in mind and the material is covered in such a way as to draw on the knowledge and experience of those attending.

The men who have attended the course have been unanimous in their opinion that the course has aided them in maintaining trouble-free systems with a minimum of effort. For its part, Motorola has been gratified in that this dependable communication tool as designed, developed, and produced by Motorola will continue to give as reliable performance through the years as when it was originally installed, through the use of correct maintenance and operational procedures by operating personnel who have attended the course.

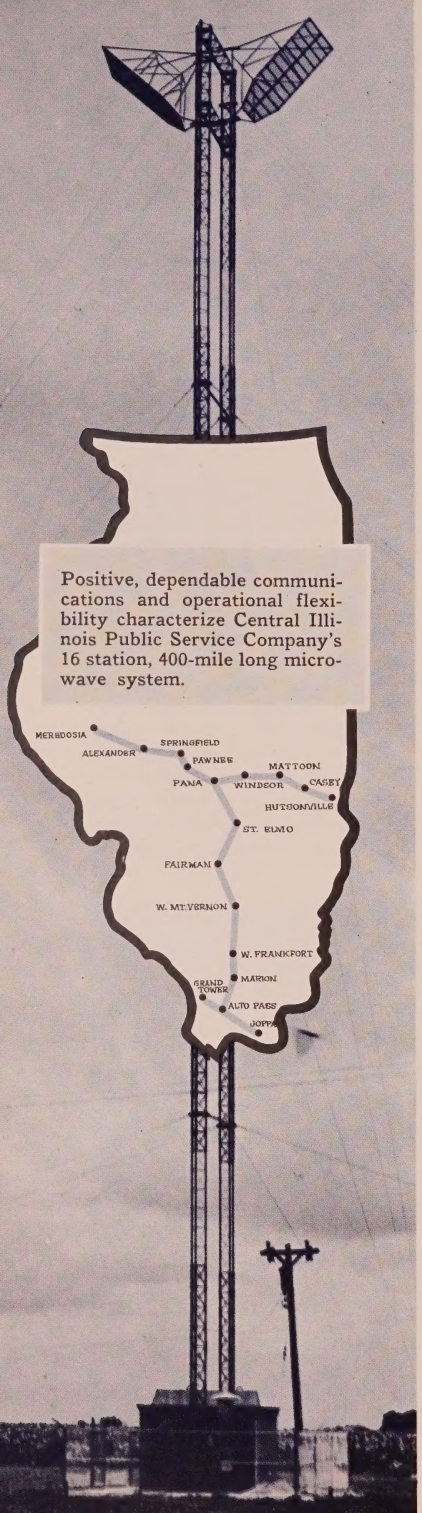


Members of the 14th Microwave School practice adjustment and alignment of a microwave system under test at the manufacturing plant. Motorola systems engineer, Arthur Kowitz, far left, explains the details.

Motorola systems engineer, James Lang, explains the functions and adjustments of a special relay used in a microwave system to members of the school in a round-table discussion.

Microwave Relay....

UTILITY'S NERVE SYSTEM



Positive, dependable communications and operational flexibility characterize Central Illinois Public Service Company's 16 station, 400-mile long microwave system.

On August 1st of this year, Central Illinois Public Service Company marked the first anniversary of the completion of its privately owned and operated half-million dollar, multi-channel microwave communications network. Approximately paralleling the Company's 138-KV power transmission system, the network provides communications to the general office in Springfield, generating stations, division offices, substations and interchange tie points.

Plans to install a private multichannel microwave system were initiated late in 1950, when because of increased business activity, the traffic became too heavy for the Company's existing power line carrier and physical telephone communication systems. These plans were quickly crystallized early in 1951 when Electric Energy, Inc. was formed to provide power to the Atomic Energy Commission's project near Paducah, Kentucky.

As part owner of Electric Energy, Inc. the Central Illinois Public Service Company was committed, along with four other electric utilities who also share its ownership, to provide interim power to the A.E.C. project during the construction phase of Electric Energy, Inc.'s generating and transmission facilities, and during full scale operation of these facilities to provide supplemental power at such times as Electric Energy, Inc., due to overhaul of equipment or for other reasons, is unable to provide A.E.C's requirements.

To meet the operating needs of the interconnected power system required additional communication and telemetering channels with circuits interconnected into the communication facilities of the other power companies.

CHANNEL UTILIZATION

The microwave network is used primarily by system supervisory personnel. As shown on the map, this supervision must reach out to each of the three generating stations located in each of the three sections of the system. In addition, instantaneous and continuous contact must be maintained with important interchange tie points. These interchanges are neighboring utility systems which, together with Central Illinois Public Service Company, form a vast interconnected electrical power system pool. Interchanges are located at West Mt. Vernon, West Frankfort and Pana with a fourth at Joppa to interconnect with Electric Energy, Inc.

Supervision of the entire system is centered at Pana where the three sections join. At Pana and at each of the three generating stations, an extensive automatic load control system has been installed to automatically load generating units to match overall system requirements. The telemetering signals to accomplish this important function, as well as the many voice circuits for

verbal instructions, are all transmitted over the microwave network.

VOICE CIRCUITS

Nine duplex private line circuits are provided for communications between the Springfield general office, the Pana supervisory headquarters and other important points in the system. From Springfield, private circuits extend to Meredosia, Pana, Mattoon, Hutsonville, West Frankfort, Marion and Grand Tower.

At each station the microwave is terminated by a PBX switchboard. Through this interconnection, these voice circuits obtain their maximum flexibility and usefulness. In Springfield, for example, this interconnection is made through Illinois Bell Telephone Company's PBX telephone switchboard located in the general office building. With this arrangement, any Company executive can talk with supervisors at any point in the system instantaneously.

Further extension of these circuits is possible through the PBX interconnections. At the Meredosia generating station, for example, the duplex voice circuits may be connected to a power line carrier circuit which extends to the Division office at Beardstown and by a carrier circuit to a group office at Quincy.

A duplex party line circuit, primarily used by supervisory personnel for conference and routine Company business, provides service to eight stations—Meredosia, Pawnee, Pana, Mattoon, Hutsonville, West Mt. Vernon, West Frankfort and Grand Tower.

To facilitate maintenance of the communications network, a simplex party line has been installed with terminations at every station in the system including the unattended relay stations.

LOAD CONTROL

The telemetering and load control circuit form an integral part of the area and load control system. Through these circuits continuous readings are transmitted from each of the system's major interconnections with other companies to the system supervisor's headquarters where they are totalized, giving a total of the area net interchange.

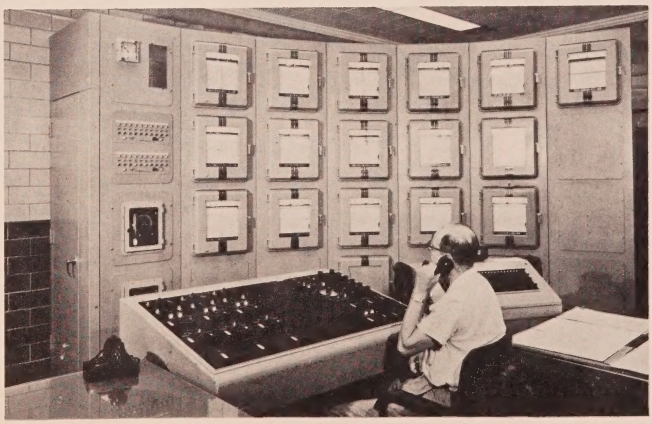
From each of the three generating stations through the telemetering circuits there are transmitted continuous readings to Pana of the individual station output. This is totalized and gives the system's total generation.

At Pana the total interchange, the total generation and the scheduled transferring of power between the companies is totalized and corrected for the frequency bias. Any amount other than zero indicates that the generating stations are off schedule. This deviation sets relays in motion which through the telemetering channels send impulses to the power stations to raise or lower its generation accordingly.

Through these same telemetering channels, information is supplied the power stations showing how much the system is off schedule and what proportion of this is assigned to the individual station for correction.

The control console at Pana is equipped to control the individual loading of the various power stations and to assign regulation to these stations as desired. Limit switches are provided to hold the automatic equipment within the limits of the capability of the individual stations. At each station there are similar control consoles which allow the plant operator to assign these control impulses to any or all of his generators and to set limits on each.

With the frequency sharing system of subcarrier multiplexing, it is a simple matter to increase the number of channels for future expansion of the communication facilities as the need arises. By the simple addition of filters, channels can be dropped, monitored or inserted at any of the stations thereby permitting maximum flexibility.



Interior of the supervisor's headquarters at Pana. Panel on the left continually monitors the operation of the microwave network.

TAXIS BANK ON RADIO

TWO-WAY RADIO IN YOUR CABS WILL PUT A JINGLE IN YOUR JEANS AND DIGITS IN YOUR BANK BALANCE.

Al Capone made money on crummy gin and beer, Andrew Carnegie had a couple of steel mills, and the Aga Khan collects his weight in diamonds every year while destitution stalks the small-town cab operator. But help is on the way.

Buzz Fowler of New Castle, Pa., hasn't bought any railroads lately, and isn't likely to, but he eats when he gets hungry and he doesn't quit 'til he's full. And he has as perfect a taxi setup as you would care to find.

ONE CAB START

Just four years ago Buzz bought a 1940 Oldsmobile, cleaned it up, and went into business, a one-cab operator in a 12-cab town. He kept the cab clean and as soon as he could he installed New Castle's first taxicab two-way radio system to provide better service for his customers. He prospered. The people of New Castle liked clean cabs and liked quick service.

Buzz added cabs and improved his radio system as opportunity permitted. Today he has 12 cabs, most of them less than a year old.

His operating principles haven't changed. All the cabs are washed at least once a day. The drivers are paid extra for cleaning a cab, so they frequently stop by at the garage to wash down their taxis when business is slack.

He has two adjacent garages in which he has installed maintenance equipment worth many times his original investment in the company of $850. All the cabs are brought into the garages for frequent, regular and complete check-ups. The facilities are more than adequate. The entire fleet is maintained in a condition of excellent repair. This care pays off. The oldest cab, purchased not quite two years ago, looks, sounds and runs as well as the newest, despite the big difference in total mileage.

Above all, he has developed the best radio system in his community. In at least one emergency the local police have sought and received his assistance. One of his cabs recently accompanied the police into an area the police base station could not reach. Communications were maintained through the taxicab system until the police solved their problem. The incident provided excellent publicity for Fowler's Taxi Service.

The heart of the radio system is the paneled dispatching office in one of the garages on the edge of town. From the office through leased wires the dispatchers remotely control the 30 watt base station on top of a hill, the highest point in the county, a mile and a quarter away.

COUNTY COVERAGE

The base station signal can be picked up everywhere in the county and at most points in the surrounding counties. One driver was dispatched to meet a plane at the Pittsburgh airport, 59 miles

away. He did not call in for sometime, so, at last, the dispatcher decided to call him. The astonished driver replied that the plane had been late and he was just leaving the airport. The dispatcher was even more suprised at the clarity of the return message.

One of the cabs is designated a control car and is driven by a supervisor. This cab carries two mobile units, one tuned to base station frequencies and the other set at the mobile unit frequencies. The usual two-way radio system employs two frequencies, the base station transmitter and the mobile receivers operate on one frequency, the mobile transmitters and the base station receiver on the other. The two receivers in the control car permit the supervisor to monitor both ends of every conversation. The control car on base station frequency is never used as a mobile unit. It is kept in reserve for emergencies. If the primary base station is taken out of service, the control car unit is connected to the stationary antenna on the roof of one of the garages and the cab becomes a temporary dispatching office.

The success of Fowler's Taxi Service is not dependent on any one factor. Buzz is a likeable, ambitious gentleman with good business sense and a lot of friends in the community. His wife and Pat, the manager, have both made good-sized contributions. The clean, cared-for look of the cabs has helped considerably. But Buzz himself insists upon giving a good part of the credit to the two-way radio system.

Such a system is easier to come by than most small town taxicab operators imagine. Motorola Communications and Electronics, Incorporated, supplier of Fowler's two-way radio equipment, has such experience-fed faith in the advantages of its product that it has evolved a seemingly altruistic financing plan. Under this plan, if the cab company seems a good risk, Motorola agrees to buy the equipment back for 100% of the loan balance in case of default. Such an agreement is of tremendous assistance in securing a loan from a local bank.

Actually, the plan is far from altruistic. Motorola has had to repurchase very few radios under the agreement. A two-way system introduces efficiency and improves business to such an extent that the additional income more than covers the regular payments.

Business is improved in several ways. The quicker service attracts more customers. The dispatcher is able to keep the cabs better dispersed, so that no cab has to travel too far to pick up a fare. No-payload cruising is virtually eliminated. Each cab is busy a greater percentage of the time.

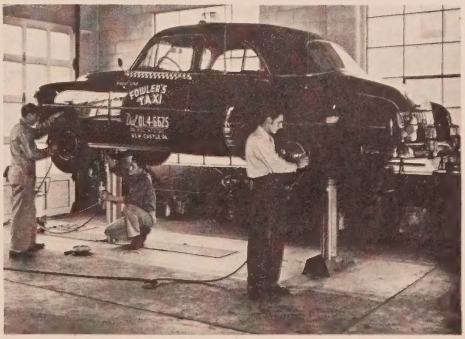
Another problem that bothers cab operators is that of obtaining a license. Actually, no problem exists. The manufacturer's representative has the forms, knows the prerequisites and is well acquainted with the procedure. With his assistance, a license can currently be obtained in about six weeks. Only the base station operators and the servicemen are required to have licenses.

COST

Cost may be a problem, although an easy solution is offered by plans such as the one outlined above. A well designed 10-watt mobile unit ordinarily costs about $450, a 30-watt desk top base station about $750. Although these units are built to very precise specifications and are relatively long lived, they may be amortized in five years. Even before that time, they will have returned their cost many times.

Maintenance can usually be arranged by contract with a radio servicing shop. Motorola, for example, has more than 700 authorized Service Stations spread throughout the country. These stations are independently owned and are selected by Motorola as the best two-way servicing facilities in the locality.

Buzz Fowler's taxi company is not an isolated instance. Many small town taxi operators use two-way radio and have found that the units pay for themselves and increase the operator's profit. Motorola's financing plans, one of which is described briefly here, were advanced only after that company had supplied many taxi firms and noted the general improvement in financial standing wrought by radio. Considering its advantages, two-way radio is a gilt-edged tool selling at bargain prices.



Buzz Fowler's maintenance methods are as modern as his operating techniques. His garage is the best equipped in New Castle. His cabs are the best looking, best maintained and best dispatched.

Is Maintenance *Your* Problem?

Almost since entering the mobile radio business, Motorola has been carefully building a National Service Organization. The service organization was established so that the user of Motorola communications equipment would have a factory recommended, competent and dependable service facility within his community.

Where the radio system is serving public safety departments of sizeable commercial operations it is frequently more advantageous for the user to employ his own service department. In such cases Motorola recommends this practice.

However, most commercial and small system operators have found that it is more economical to have outside organizations maintain their equipment. It is for these people that the National Service Organization was established.

Today, over 700 Authorized Motorola Service Stations are located throughout the United States.

Each Motorola Service Station (MSS as they are called) is a privately owned radio communications service company which was carefully screened, qualified, trained and authorized by Motorola.

As part of its agreement, Motorola provides the authorized service company with a complete set of technical literature including service bulletins, training programs, instruction manuals and specification sheets. In addition, business guidance, cost analysis and administrative counsel are provided.

This vast maintenance organization is another Motorola service to further assure the user that he will not have problems of maintenance with his equipment. So with the extensive Motorola service organization, it is possible for the user to have the entire package—engineering, equipment, finance, installation and maintenance with the one company—the designer and manufacturer of his equipment.

The Motorola organization stands behind the 2-way radio system not only for engineering and installation, but also for maintaining the equipment consistent with the established high factory standards.

Too, the user of the equipment does not have to search for a competent service organization to maintain his equipment.

The user is further assured that the continuity of maintenance will not be broken because he is contracting with a well-established, financially-sound organization.

Standard rates for servicing are stabilized by Motorola. In the event of a multiple subcontract where the user has his radio units spread throughout several communities requiring that several different subcontracting MSS maintain the equipment, the user is invoiced from one source only. This saves on bookkeeping and general confusion especially when the radio units are transferred back and forth between communities.

By negotiating with the single responsible company, the 2-way radio user may contract for the complete communications service —engineering, equipment, finance, installation and continued dependability through reliable, competent maintenance.

2-WAY RADIO IMPROVES CUSTOMER RELATIONS

Speedy Service Both Amazes And Pleases Customers Adding Plus Benefits To The Use Of New Efficiency Tool

Since adding 2-way radio to improve service, speed repairs and generally expedite work in three of their divisions, the Community Public Service Co. of Texas has encountered an unexpected enthusiasm on the part of its customers for their newest efficiency tool.

Brazoria, Texas Serviceman Quinton Dearing had a typical experience recently. A Mr. Dingle, a prominent Brazoria County rancher, phoned the West Columbia office, which lies eight miles from his ranch, to report "Lights out." The dispatcher immediately radioed Dearing whom he knew to be in the same general area as the ranch. Dearing happened to be less than a mile away and a very few minutes later rolled up to the door of the ranch house.

Customer Dingle walked over to the pickup, astonishment and awe on his face. Looking over the truck carefully, he asked "Does this thing fly?"

Of course all emergency calls can not be handled quite as speedily, but often a mobile unit will be in the vicinity of such a call and can reach the customer's place in record time.

In addition to the customer's satisfaction at prompt service, the time saved by the serviceman in not returning to the office for further orders, perhaps to retrace his steps to the very vicinity he just left, can be considerable.

The company first installed Motorola 2-way radio in their Southeast Division in 1951. It proved so effective that the Western and Central Divisions were equipped with radio shortly after. Today, they are operating eleven base stations spread throughout Texas with over 100 mobile units.

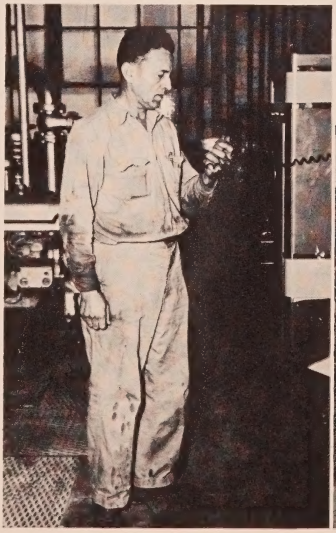
Promptly restoring service to an industrial customer is usually of great importance because a current outage may idle hundreds of men, completely stop production and be very costly to the customer. How their radio system helps them in such an emergency was reported recently by Texas City, Texas Manager Loy Jordan.

"One day recently we had left the office about 3:30 P.M. to be gone about an hour on a routine service call. Three blocks from the office, a radio message intercepted us with word that power was off at the big Sid Richardson Refining Company.

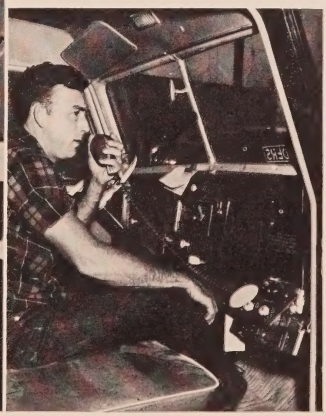
"We hurried to the Refinery and started investigating the trouble. Ten minutes after receiving the radio message we discovered that a crane operator had swung a cable into the 12.5 kv. line serving the Refinery, burning down the line.

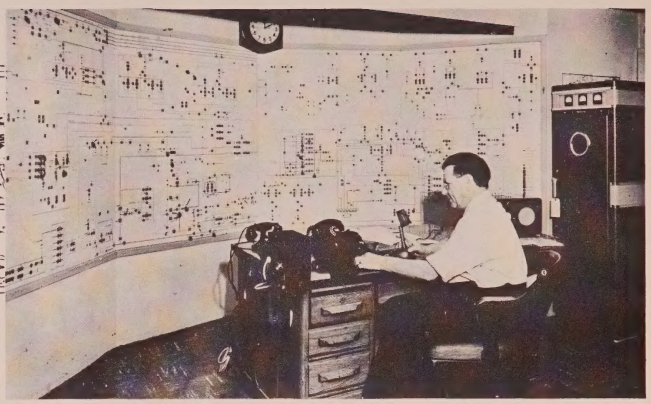
"We contacted Line Superintendent L. P. Acklen by radio and he immediately dispatched a crew to help make the necessary repairs. The radio was used also to clear the circuit for repairs and to energize the line after repairs were completed. Two-way radio thus helped us restore service to this important industrial customer in a fraction of the time that would have been required otherwise."

Left, George Adams, superintendent of Pecos power plant, Pecos, Texas contacts Lineman Fred Lane, in Mobile Unit 45, right, for further check on reported industrial outage.



Photos Courtesy of Community Public Service Co. "THE COMMUNICATOR"





WHEN LIGHTNING STRIKES

New 2-way Radio System Enables The Puget Sound Power & Light Company to Restore Service In Record Time.

With their new 2-way radio installation now completed, the Puget Sound Power and Light Company is ready for fast and efficient trouble-shooting. Two-way radio dispatching for instant contact with electric line trucks and service cars has now been completed for the Puyallup Valley (Tacoma) area, announced H. E. Spear, local manager.

Early this year, the company established a system operator and service dispatching center at Puyallup making it the nerve center for its integrated transmission and distribution in the area.

Costly manpower and equipment are fully utilized. Service truck and car dispatching is swift, sure and efficient. When a job is completed the repair crew radios the dispatcher from the cab of the service truck for further instructions. No unnecessary time is lost searching for a phone or driving back to headquarters.

When an emergency occurs, the dispatcher is able to select the crew best able to handle the job. Too, he can assign it to them immediately and directly.

In an emergency before the installation of radio, the Puyallup dispatcher necessarily had a "catch-as-catch-can" operation. If there were no service vehicles in the shop, the dispatcher had to wait until a crew called in. The first crew to call in got the assignment despite work load, distance or any impracticalities if the emergency involved a job of some magnitude.

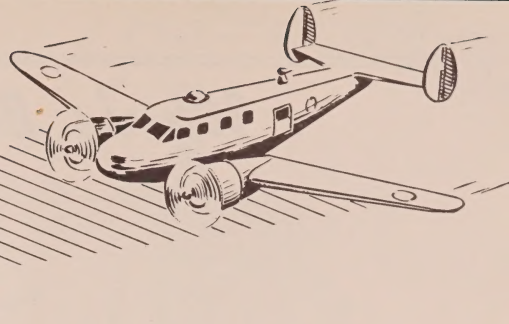
During a severe electrical storm when communications are needed the most, many times the telephone circuits are down. Previously, this necessitated a time consuming trip back to Puyallup or one of the other maintenance headquarters. Now, this situation does not occur. A service truck may be switched back and forth between breaks as they are reported. In this way, they are able to keep a crew or crews busy all day without their having to travel back to the shop once.

The 60 watt radio transmitter at the Puyallup headquarters has a fully automatic emergency power generator rated at one kilowatt. Thus, they are prepared for any emergency.

Clyde Kandle, outside serviceman at Puyallup, receives a call from the service dispatcher via their new radio system.

With the 2-way radio system, the Puget Sound Power and Light Company is enabled to fully coordinate its field activities. The radio dispatcher keeps in touch with the repair crews and shuffles them from one trouble spot to another as needed with a minimum of effort. In addition, truck crews working on the same job although separated can now coordinate the work effectively.

Plant Protection Modernized At Beechcraft



Getting the word through in emergencies has been doubly assured by the plant protection department of the Beech Aircraft Corporation of Wichita, Kansas. Their new, modern two-way radio communications system is being lauded by company officials and employees alike.

Two company station wagons and a jeep have been equipped with very high frequency Motorola two-way radio units. Operating on the same frequency, the men in these cars are able to talk with each other and with the control center in the plant protection office. For close-in emergency work where the cars are unable to travel, four lightweight, portable "Handie-Talkie" radiophones are available.

The new equipment got its first emergency workout recently when hail and 100 mile-an-hour winds ripped through Wichita. With the aid of the two-way radio unit installed in his car, Bruce Dorman, chief security officer, maintained direct contact with the plant while making an inspection tour of company warehouses in the hard-hit downtown area. He radioed his instructions to the other radio-equipped guards and within minutes the damaged buildings were under tight security.

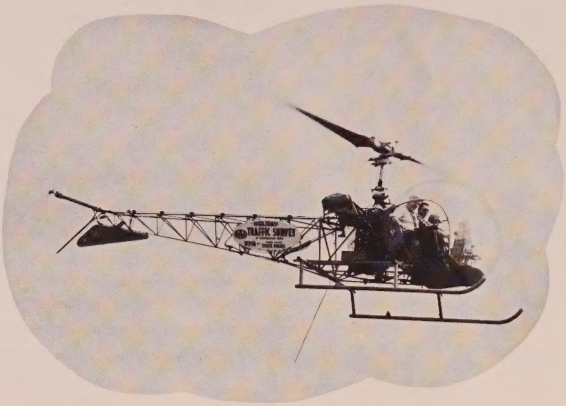
Dorman said, "Although the primary purpose of the radio system is to handle emergencies, it is also being put to good use in controlling company cars on a 24 hour schedule in the downtown area. In operation only a week, it has already saved us numerous trips."

Dispatcher Sergeant D. L. Parr in the plant protection control office uses the new two-way radio system to contact a foot patrolman in the plant yard.

Beech Aircraft Guard Edward Kliewer radios the base station for further instructions.

With his lightweight, portable "Handie-Talkie" radiophone, Guard Captain E. M. Blackmore quietly directs the disposition of the security guards even while on foot through the plant area.

Whirly Bird's-eye View



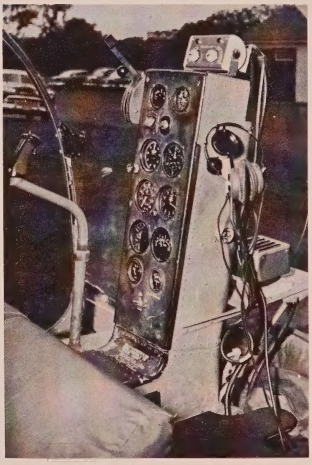
AERIAL SURVEY

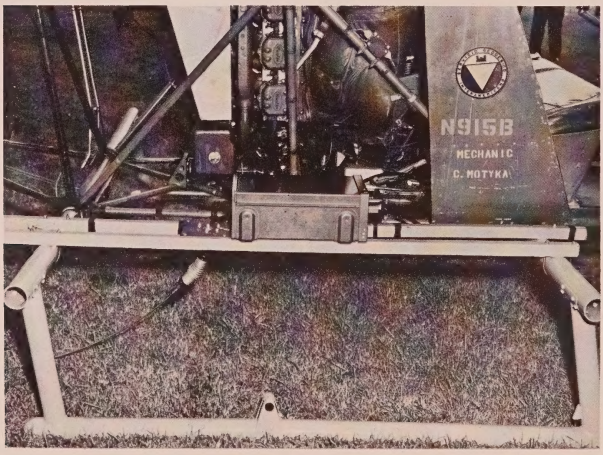
RELIEVES

HOLIDAY ROAD

CONGESTION

Via 2-way radio, observers in this helicopter reported Labor Day traffic bottlenecks to the state police who in turn relayed the information together with suggested alternate routes to the radio station for rebroadcast to the motorists.





ABOVE: Close-up view showing the 2-way radio controls mounted within easy reach above the instrument panel. LEFT: Two wooden spars support the rear-mount radio equipment and antenna behind the canopy. The Rhode Island State Police, the Automobile Club of Rhode Island and Providence radio station WPJB teamed up to conduct the "Traffisurvey".

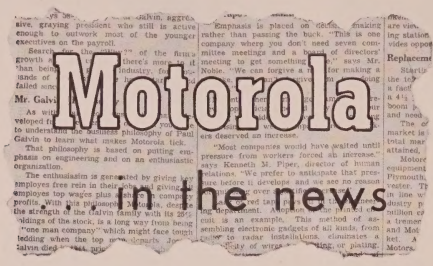
Radio Communication Unifies Oil Operations

DRILLING SUPERVISORS WITH RADIO EQUIPPED CARS OF THE UNION OIL COMPANY OF CALIFORNIA REPORT TIME ECONOMIES OF SEVERAL HOURS DAILY.

ABOVE: At a remote drilling location, K. W. Brown, drilling foreman, finds the two-way radio system an invaluable time saver. The easy mobility of radio makes it the perfect communication tool for oil drilling operations.

ABOVE: Blaine Hughes, production foreman at Orcutt, California, can reach or be reached anywhere through his radio equipped car.

RIGHT: The telephone operator at the Orcutt office of Union Oil Company relays information received over the phone to a supervisor traveling along the road in his radio-equipped car some miles distant.



New York Daily Mirror Photos

ABOVE: John J. Reidy, chief photographer for the New York Daily Mirror is shown with radio equipment and special cameras demonstrated to editors, photographers and production men attending the First Annual Rochester Photo Conference at Rochester, N. Y.

LEFT: Charles B. McCabe (right), publisher of the New York Daily Mirror demonstrates latest Motorola "Handie-Talkie" Packset to Mary Margaret McBride, veteran radio personality. Radio permits Daily Mirror reporters and photographers to talk directly with city desk.

★ ★

Shown at the recent Radio Technical Commission for Maritime Services (RTCM) fall assembly are (left to right): Capt. R. M. Ross, USCG and general chairman of the assembly, FCC Commissioner E. M. Webster and Local Chairman K. B. Glentzer, Illinois Bell Telephone Company.

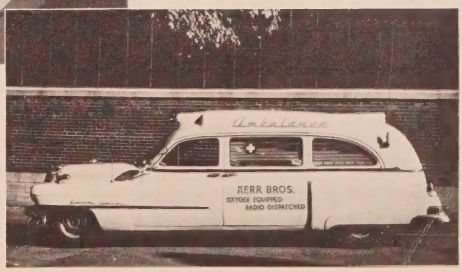
Commissioner Webster holds Motorola's new pint-sized eight tube "Handie-Micro-Talkie" transmitter shown at the meeting.

ABOVE: Miss Barbara Waldron, Washington, D. C. division dispatcher for the American Automobile Association, sends aid to a stranded motorist via two-way radio. This metropolitan system operates in the 450 mc. band.

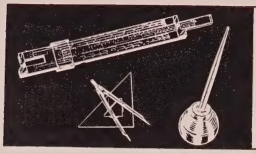
Travel Topics

ABOVE: This horse-drawn St. Louis, Missouri cab may not move fast—but not for lack of communications. The early nineteenth century surrey is equipped with modern two-way radio.

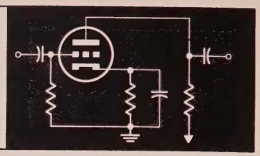
ABOVE: Associated Dispatch Corporation dispatchers Miss Billie Sue Goodson (left) and Mrs. Edith Fathergill handle radio messages from over 60 radio-equipped vehicles. Associated Dispatch Corporation operates as a Miscellaneous Common Carrier service in the Lexington, Kentucky area.



RIGHT: One of four Kerr Bros. ambulances equipped with two-way radio by the Associated Dispatch Corporation. These ambulances operate all over central Kentucky.



Technical Notes Section



RADIO OPERATING

The primary function of any 2-way radiotelephone system is the transmission of intelligence. Does your system fulfill its function adequately?

The licensees of some radio systems demand brisk, crisp message handling—others prefer the casual approach—many have little or nothing in the way of set routine. Yet, any of these types of operation may or may not be efficiently transmitting intelligence. When good equipment has been installed in a satisfactory location, the remainder of the problem is in the hands of the radio operator.

One basic precept to follow is that every message not transmitted with complete clarity will be garbled in reception and that every message which might be misunderstood at the receiver will be misunderstood. Thus, every message should be handled individually and distinctively. Except in unusual cases, repetition and explanations should not be required.

SPEECH

Until recently, very few communications radio operators have been specifically chosen for their voice qualities as is done in the radio broadcast industry. While it cannot be expected that the communications operator's speech should be equal to that of a broadcast announcer, each operator and each chief operator should strive for that goal. Further, each operator should be familiar with the full scope of operations he directs and be fully conversant with all terms employed in the performance of his duties. Similarly, if each mobile operator is familiar with the standard operating terminology, needless explanations can be avoided.

Speech training programs conducted by a chief operator, or even practice by the individual operators will add much to improving efficiency of message transmission. A tape, wire or disc recorder provides an excellent medium for speech analysis. A little diligence can transform an average or poor operator into a good operator. Among the speech factors to be considered are voice level, voice quality, pronunciation and enunciation.

While FM does provide the best medium for voice transmission, it alone cannot improve poorly spoken messages. The message which is received with maximum clarity is that which is spoken in a normal voice, slowly and distinctly. A low voice level into the microphone will result in a low voice level out of the speaker. A loud voice, i.e. a voice louder than that necessary to produce full modulation, will not produce greater speaker output since it will be limited in the transmitter. In fact, shouting, or a loud or emotional voice is more difficult to receive than a normal voice primarily because of the added voice distortion.

PRONUNCIATION

Unless corrected by training, many people normally tend to speak too rapidly, to slur words and phrases and to fail to open the mouth sufficiently when speaking. Radio operators should take special care to speak with the mouth open, to avoid a nasal or guttural tonal quality, to pronounce each individual syllable of each word, enunciating clearly, to maintain a fairly constant voice level and to speak slowly so that each syllable will be clear and distinct. Breath control and proper use of the throat, mouth and lips are all important parts of each of these functions.

Difficult words should always be spelled out. The phonetic alphabet should be employed whenever it is necessary to distinguish letters clearly. For example, "Baker" and "Peter" are much easier to differentiate at the receiver than are "B" and "P".

While a speech clinic at a local educational institution can be of great value in speech improvement, attention to the fundamentals and continuing practice, striving for improvement, can achieve adequate results.

PRACTICES

It is, of course, necessary to have suitable performance specifications in the radio transmitters and receivers and adequate maintenance plus proper level settings for the system. Yet, this is not fully adequate as far as equipment performance is concerned. The base station dispatcher should be located in an area free of ambient noise. Background noise interferes with both transmission and reception. Noise cancelling microphones should be used if necessary. A sound-proofed radio operating room is highly desirable. Similarly, location of the base station equipment in an area of high RF noise level can cause degradation of intelligibility. A remotely controlled base station in a quiet area can reduce this problem. With these considerations taken care of, other practices can improve message handling.

Each operator should be instructed in proper microphone usage. While the distance between the operator and the microphone may vary somewhat in different installations, the operator should be aware of the best distance for his voice. Low microphone sensitivity settings make it difficult to achieve full modulation; high sensitivity may pick up too much background noise. The operator should speak across the face of the microphone, avoiding breathing into or blowing into it. A military type microphone should be held within one to two inches of the lips and at an angle of about 30° with the lips. The push-to-talk or transmit switch should be held down firmly during the entire message transmission, and speech should not be started unless the switch is "on".

CODES

Code systems have come into widespread use to shorten message transmissions. Probably the best known code is the "10 Signal" system employed by law enforcement agencies. Other codes such as specific numbers assigned to vehicles, to routine operations and to specific working areas can do much to simplify message transmissions to mobile units. A practice as simple as a momentary depression of the "transmit" switch to acknowledge message receipt without voice transmission has been employed. A code system for a specific application can be easily developed and can save considerable "air time", improving message handling efficiency. Even on an uncrowded channel, adoption of a code system prepares the staff for the expansion of the system when transmit time may be more valuable. It also provides a solution to channel sharing problems with other radio systems if they arise.

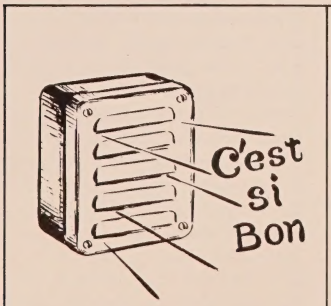
RULES FOR OPERATORS

1. Speak in a normal voice.
2. Keep your voice level constant.
3. Speak slowly and calmly.
4. Pronounce each word and each syllable.
5. Spell difficult words.
6. Use the phonetic alphabet.
7. Keep messages brief but complete.
8. Use the microphone properly.

The code system achieves the result of transmitting sufficient information without the time wasting processes of calls for additional information and wordy messages containing more data than required for a mobile unit to complete its assigned tasks. With or without codes, messages should be kept brief and concise, but not at the expense of making the messages incomplete.

CHECKS

As a rough rule of thumb, if it is necessary to repeat messages, or if messages are consistently misunderstood, the operator responsible should have further training. If you are an operator, check yourself; if you are a chief operator, listen to your staff. Find out if you can improve your system in its primary function.

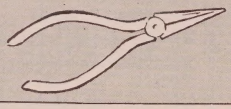


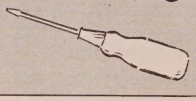
Spell out difficult words.

Shouting into the microphone impairs intelligibility.

Code signals simplify message transmission.

SERVICE HINTS and SHOP NOTES





POWER SUPPLY

From Herbert A. Rosenberg, MSS at Bridgeport, Connecticut, comes a suggestion on how to make a low current 6 or 12 VDC source capable of supplying sufficient current to bench test a 60 watt mobile unit, minimizing the amount of power source equipment required in the shop.

Mr. Rosenberg has constructed an AC power supply chassis capable of supplying approximately 600 VDC at 400 ma. With a 6 or 12 VDC power source capable of supplying sufficient current for tube filaments and relays and vibrator supply drain, a 60 watt mobile unit can be operated by supplying the transmitter plate voltage from the AC power supply.

The high voltage pins are disconnected from the dynamotor and plugged into the DC output of the AC power supply. The primary power lead from the dynamotor relay to the dynamotor is disconnected to completely disable the dynamotor. The dynamotor relay is then used to key a high voltage relay on the AC power supply chassis, through clip leads, whenever the push-to-talk button is depressed. Thus, a DC power source capable of supplying the "receive" power requirements for the mobile unit is adequate for full testing. Note that it is necessary that the AC power supply have a floating ground.

TEST SET

For convenience, Ed Arms of Casa Grande, Arizona, has mounted a P-7208 Antenna Dummy Load under the meter panel of a P-8501-A Portable Test Set, just above the meter. The coaxial plug of the load projects through the panel for connection to a transmitter. The dummy load output circuit is connected to the meter selector switch in parallel with the lead from the "Field Strength" circuit. Thus, by flicking the meter switch to "Field Strength", power can be measured during a transmitter alignment procedure. A common ground circuit from the dummy load to the test set must be used to avoid body capacity effects. The crystal rectifier in the dummy load should be connected for a positive meter reading, the same polarity as the output of the "Field Strength" circuit.

The Motorola Engineering Department recommends two cautions in the use of this arrangement. Since the full transmitter power is dissipated in the dummy load, considerable heat can be generated within the test set. The dummy load should thus be used only intermittently–a few seconds at a time at the most. Secondly, paralleling the dummy load with the field strength circuit may affect the calibration of the dummy load. Calibration should be checked before relying upon the dummy load for precise measurements. Bulletin SRN-74 describes an alternate method using a separate meter.

METERING

For installations with a spare control line, A. E. Gilbeau of Stockton, California, recommends a remote frequency indicator. With the spare line plugged into metering position 4 on the receiver chassis or on the meter switching chassis, and with a 50-0-50 microammeter at the remote control console, the frequency of the received signals can be continuously compared with the receiver frequency. It, of course, is also possible to remotely meter limiter readings for signal strength if desired. Metering in this manner requires that the resistance of the control line not be appreciable as compared to the resistance of the metering circuit and the meter.

LINE PRESSURE

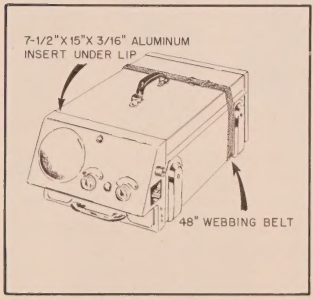
From RCE Bob Whiffen comes a suggestion which offers protection to air dielectric transmission line. If the pressure gage sticks, a leak in the line can lead to undetected deterioration through moisture collection in the line. Thus, a periodic check for leaks and a defective gage can be made by increasing the line pressure slightly above normal. After a reasonable time has elapsed to insure that the line does hold pressure and that the gage is indicating properly, the excess pressure can be released and the line returned to normal condition.

TUBES

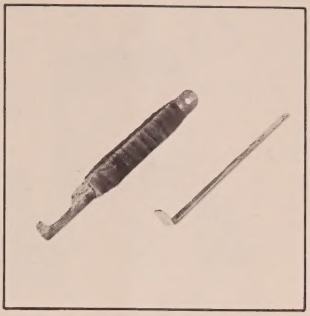
The final amplifier tubes used in Motorola 250 watt, 152-174 mc. final amplifier chassis have long been identified as 4-125-A's. With the recent adoption of the RETMA designation of 4D21 for these tubes, some confusion has arisen. The following tubes are Motorola approved for use in the above mentioned P-8310 series chassis: 1. the 4-125-A/4D21 produced by Eimac, 2. the 4D21 produced by Penta Labs, and 3. the 4D21 produced under the RCA label.

CARRIER

An adaptation which can easily be made to make a 10 watt Uni-Channel ("41V" and "41B" series) mobile unit readily transportable is illustrated in the accompanying sketch. A sheet of 3/16" aluminum is cut 7-½" wide by 15" long. A luggage carrying handle is riveted or bolted to the sheet near the center, at the point which provides best balance. The sheet is then placed on top of the housing and inserted under the lip of the front panel. A heavy canvas web strap, preferably at least 48" in length is used to hold the rear of the plate to the housing. The same strap can then be used to hold down the radio unit in a temporary installation.



A convenient carrier for a Uni-Channel mobile on AC Utility unit can be constructed of sheet aluminum.



Hand made tools used by MSS operator W. T. Peacock to simplify rooftop antenna installation.

TOOLS

The accompanying illustration shows two handmade tools devised by W. T. Peacock of St. Petersburg, Florida. One is a broken hacksaw blade with a cutting edge ground into it. Rubber electrical tape, wound around one end, provides a handle. The second is the antenna wrench, Part No. 66A480578 supplied with the P-8553 series mobile antennas, with cutting edges ground on the short end.

Either one of these tools does a fast, easy and effective job of removing the tarry insulating compound from around the underside of the antenna mounting hole in the roof of the car, easing installation and insuring a good ground circuit.

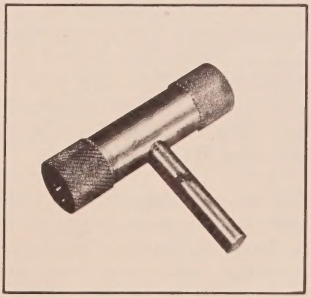
ANTENNAS

Two models of 152-174 mc. antennas are available for mounting directly on mobile or AC Utility radio units in compact installations. Both models include a stainless steel "Whip" approximately 18" long fitted with a connector which mates with an SO-239 or equivalent VHF type connector. This antenna itself, the model P-8654, is the same as is used on "Handie-Talkie" portable radiophones. A second model, the P-8654-A, consists of the P-8654 Antenna plus an M-359 (Part No. 28A48250) type VHF right angle adapter for mounting the antenna vertically from a horizontal socket. Use of either of these antennas in place of the conventional rooftop antenna permits simplified installation on fork lift trucks, for semi-portable usage and for similar applications.

If desired, an SO-239 female type UHF connector can be mounted in a hole on top of a mobile housing to accept a P-8654 Antenna. The hole should be located to preclude interference with internal components. Components required for this modification may be ordered from the Motorola Parts Department and include: 1-P-8654 Antenna (specify frequency), 1-1X803819 Cable and Connector Assembly, 4-3S1943 screws (4-40 x 5/16), 4-4S9761 lockwashers (#4 int.), 4 nuts (#4-40 x ¼) and 1-32A482067 gasket.

FUSE CLIPS

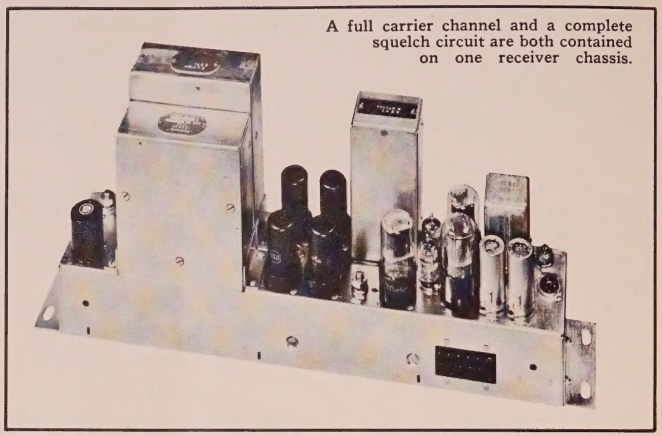
To aid in maintaining low contact resistance at fuse clips, Gerry Peterson of San Luis Obispo, California, has made a handy burnishing tool. A turned steel rod with knurled ends, provided with a short steel handle is dimensioned to fit into a 50 or 60 amp. fuse clip. Rocking the handle back and forth will burnish the contact area of the clips. The knurling must be kept as fine as possible to avoid scratching the clips deeply.



MSS operator Gerry Peterson constructed this tool for burnishing fuse clip contacts.

Operational Security

Error-free Operation Using Audio Frequency Carrier with Squelch



A full carrier channel and a complete squelch circuit are both contained on one receiver chassis.

When the utmost in dependability must be achieved in an Audio Frequency Carrier system, Motorola AF Carrier with squelch reaches the goal.

The differential squelch circuit included is designed to guard against undesired or false operation of the AFC receiver channel end device under conditions of unusable signal-to-noise ratio on the audio channel provided by the wire line, VHF radio, power line carrier, microwave or other transmission medium. This could be the result of a complete or partial fade of the transmitting medium or by the introduction of noise bursts or pulses by some external source. The function of the squelch circuit is to continuously monitor channel signal level and signal-to-noise ratio and provide high speed indication of substandard conditions plus protection from spurious operation.

It has wide application in multiplexing systems transmitting load control signals, critical telemetering signals requiring immediate alarm of data failure, supervisory control signals, and remote control and indication signals.

SQUELCH

The squelch signal amplifier and noise amplifier both feed a comparator. The noise signal is from a channel unoccupied by carrier; the input filter excludes all AFC signals. By this means, the signal-to-noise sensitivity of the comparator is highest, since from the standpoint of audio channel energy, there is little or no difference between 18 normal AFC signals in the absence of noise and full broad band noise in the absence of signals.

When substandard conditions exist, a blocking or squelch output results which de-energizes the hermetically sealed, high speed squelch and alarm relays. Contacts on the squelch relay are connected to prevent erroneous signals from leaving the receiver. The contacts on the alarm relay can be used to assist squelch relay operations or to provide a channel supervision alarm where required.

PROTECTION

The circuit provides squelch action and, if required, alarm action, under conditions of; loss of channel signal regardless of noise magnitude, signal-to-noise ratio below a preset standard, loss of all signals in the presence of noise, entire audio channel absence, loss of primary power and filament failure of any tube in the unit. Instantaneous fail-safe operation and protection are provided.

Substantial safety margin to block erroneous output data is provided by designing the squelch circuit to react in only 1/3 to 1/2 the time required for the carrier channel to respond. A suitable time delay is inserted in the squelch release time to insure that the false signal has completely cleared the receiver before any signals are allowed to pass.

Mechanically, the receiver with squelch resembles a conventional two-channel receiver chassis. The place of one channel is utilized for the noise and squelch circuitry. Only one noise filter is used for any group of AFC receivers on a common circuit at a given location. "Slave" squelch circuits of other receivers provide each channel with its own independent squelch action.

With this chassis, Motorola has added another engineering accomplishment to provide ever finer communications facilities.

NEW PRODUCTS

APERIODIC COUPLER — POTENTIAL DEVICE FOR POWER UTILITIES

Retaining the basic principles of the high pass filter but completely redesigned from the base up, the new Motorola Aperiodic Line Coupling Units and Potential Devices cover a wider range of applications in an expanded group of voltage classification, providing improved electrical and mechanical characteristics.

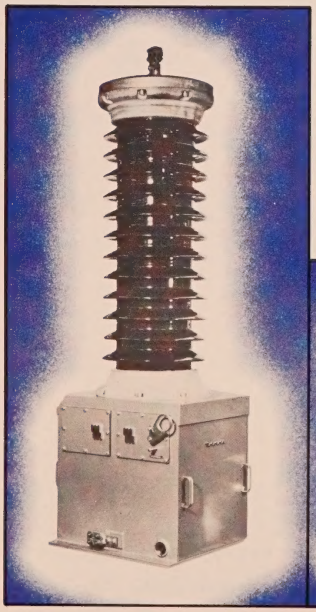
MECHANICAL

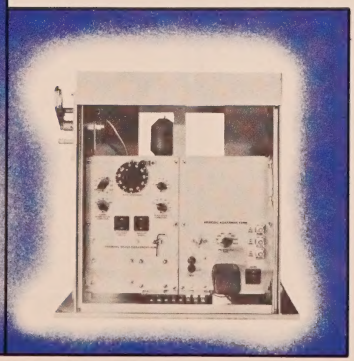
The new capacitor stack is more compact than that of the previous models even though the capacitance is increased. Over-all height (capacitor and base) is 49-½" for the 46 kv. unit and increases up to 159-⅝" for the 345 kv. unit. This is from 2" to 25" shorter than the previous models. A new oil seal on the capacitors insures longer life by achieving a permanent hermetic seal closure.

The rectangular base is 21-½" square and contains the Aperiodic Adjustment Panel and, if required, the Potential Device Adjustment Panel. The Potential Device Adjustment Panel is also available in a separate weatherproof housing for wall or pole mounting. The entire unit can be pedestal mounted or, if desired, suspension mounted using a clevis at the top. Large access doors are provided in both the front and rear of the base.

ELECTRICAL

The new capacitor stack features greater capacitance than any comparable unit, achieving lower coupling losses and better potential device voltage regulation. For example, the capacitance of the 46 kv. unit is .015 mf with less than ½ db. carrier coupling loss from 50 kc. to 200 kc. The capacitance of the 345 kv. unit is .002 mf. Complying in full with AIEE Standards #31, the Coupling Units and Potential Devices are available in the 46 kv., 69 kv., 138 kv., 161 kv., 230 kv., 287 kv., and 345 kv. insulation classes for rated line-to-ground voltages from 26.6 kv. to 199 kv.





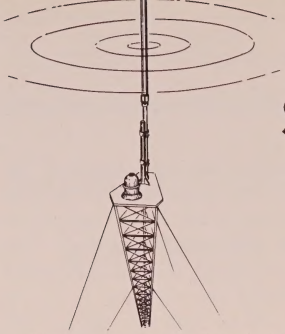
Left: 115 kv. Aperiodic Coupling Unit

Below: Internal view of base with Aperiodic and Potential Device Adjustment Panels

Now capable of coupling up to 100 watts of power line carrier energy to or from high voltage transmission lines, the coupling unit will match line impedances from 50 to 1800 ohms with a 50 or 100 ohm carrier terminal. Only one tuning adjustment is required; a single adjustable coil tunes the high pass filter to couple all carrier frequencies above 50 kc. from one or more carrier terminal units.

The potential device provides a main output of 115/66.4 VAC and an auxiliary ungrounded output at 115/66.4 VAC simultaneously for operation of meters, relays, indicators or synchronizing apparatus. Under conditions of fixed burden, the voltage is correctable to zero error. With varying burden, the error is substantially less than the tolerance allowed by AIEE Standards #31.

Safety protection includes "dead front" adjustment panels, separate heavy duty grounding switches with positive detents in both positions for both the Coupling Unit and the Potential Device and high voltage protective gaps for both units. The grounding switches are easily operated with a standard "hot stick." Safety as well as performance has been designed into these new units.



Selecting Transmission Lines

A high powered transmitter is not always the answer to a full range coverage problem. Often the choice of the proper antenna and transmission line system will provide a more practical, more economical solution.

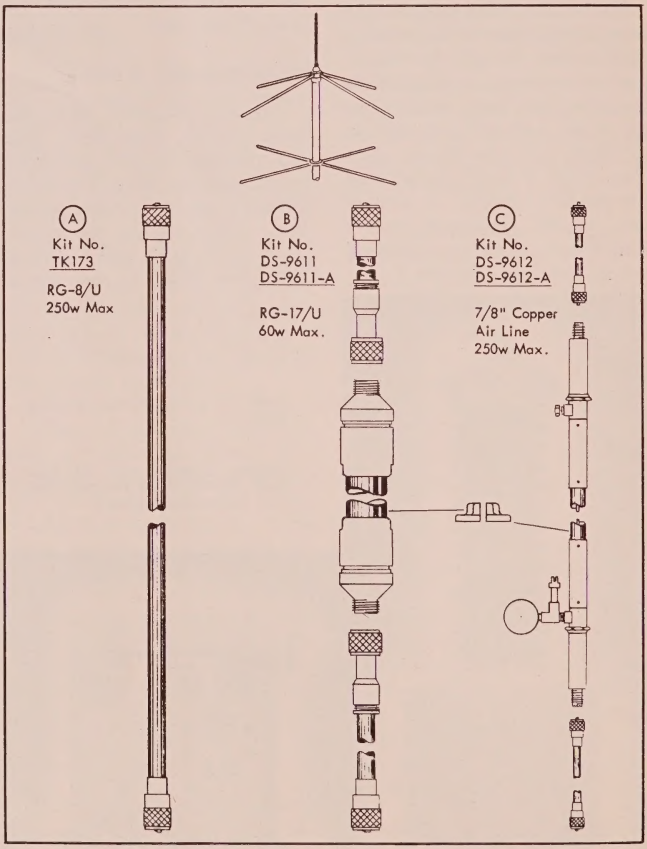
There are virtually infinite numbers of combinations of transmission lines, adapters, connectors and fittings which can be used to convey energy between a radio installation and its antenna. A library of catalogs, tables of technical specifications and an ever-ready slide rule may set up a theoretically perfect transmission system but, hidden shortcomings of some connectors, excessive costs of other components and completely unsuitable delivery schedules on some critical parts may tend to destroy the entire illusion.

Still another factor, it is false economy to attempt to obtain full coverage with a more expensive high gain antenna then economize by using inexpensive line. Line losses can often be sufficient to completely offset the antenna gain.

As a result of years of experience in the needs and desires of its customers, Motorola has set up complete transmission line kits containing all components necessary to interconnect the radio unit and the antenna. Factors taken into account are achievement of a suitable impedance match with minimization of discontinuities, lowest losses consistent with costs and ready availability of all components.

CABLES

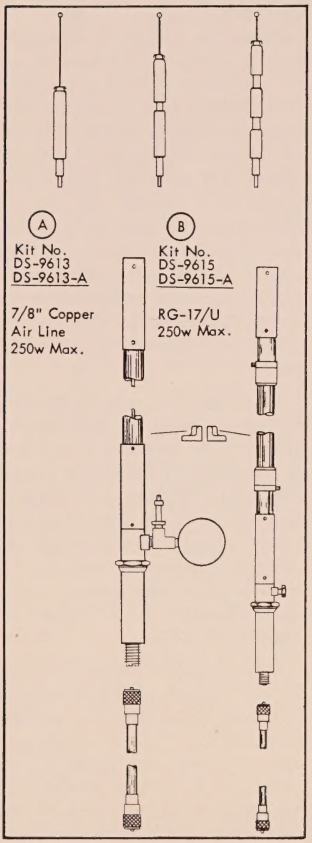
The least expensive and most easily handled transmission line is 52 ohm solid dielectric line RG-8/U. For limited lengths (short antenna line runs) RG-8/U is fully satisfactory. For long runs, losses may become excessive, particularly at the higher frequencies. For example, the power loss in 100 ft. of RG-8/U at 160 mc. approaches 3db. (50%). A 200 ft. line will deliver only 25% of the input power. These figures account for normal line losses alone; with serious impedance mismatches, the power loss could be considerably greater.



Transmission line kits available for the Motorola P-8351 "Isoplane" Antenna.

Another type of solid dielectric 52 ohm transmission line is RG-17/U. Physically larger than RG-8/U (approximately 7/8" in diameter), RG-17/U has less than half the loss of RG-8/U. The connectors available for use with RG-17/U, however, are sometimes limited in power handling capabilities. Either RG-8/U or RG-17/U cable can be used for short runs where the losses are tolerable in comparison to cost.

The most desirable type of line from the standpoint of minimizing line losses is coaxial copper line with air (or gas) dielectric. For the 25-50, 72-76 and 152-174 mc. ranges, 64 ohm 7/8" copper line such as Andrews type 737 is recommended. The loss is less than .7 db. per 100 ft. at 160 mc. At higher frequencies (in the 450-470 mc. range) impedance match and losses become increasingly important and 50 ohm 7/8" line (Andrews type S-450 or 740) is recommended. At these frequencies, type 740 line has a loss of less than 1 db. per 100 ft. Further improvement can be realized by using type 738 (Teflon insulated) line but cost becomes a factor for the slight improvement gained.



Transmission line kits available for the Motorola P-8250, P-8450 and P-8350 Coaxial Skirted Antennas.

CONNECTORS

Certain connectors create impedance discontinuities, others are limited in power handling capabilities, still others require special adapters or a greater number of components. All of these factors are balanced against cost to arrive at optimum assemblies for the Motorola kits. Wherever possible, standard Army-Navy approved components are used.

KITS

Each transmission line kit provides the complete interconnection between the radio unit and the antenna. Connectors are attached to the length of line specified. A tube of silicone grease and a roll of vinyl tape are included for weatherproofing the connections. All adapters and fittings are supplied. For 737, RG-17/U and 740 line, two kits are available for each antenna, one with and one without the K-9254 Collar Clamp Kit for cable entrance into upright cabinets.

Wraplock (stainless steel tape, keys and installation tool) for fastening the line to the tower and antenna mounting clamps must be ordered separately if not supplied witn the antenna.

Full information on these kits is contained in a series of Antenna System Diagrams recently published by the Technical Information Center.

ANTENNA	LINE	KIT
P-8351 DS-9639 DS-9653	RG-8/U	TK173
	RG-17/U	DS-9611* DS-9611-A
	737	DS-9612* DS-9612-A
P-8250 P-8350 P-8450	RG-17/U	DS-9615* DS-9615-A
	737	DS-9613* DS-9613-A
DS-9677 DS-9678	RG-8/U	DS-9618
	RG-17/U	DS-9617* DS-9617-A
	737	DS-9616* DS-9616-A
DS-9600	RG-17/U	DS-9620* DS-9620-A
	737	DS-9619* DS-9619-A
DS-9687	RG-8/U	DS-9624
	RG-17/U	DS-9623* DS-9623-A
	737	DS-9622* DS-9622-A
TU114 DS-9602 DS-9603	RG-8/U	DS-9627
	RG-17/U	DS-9626* DS-9626-A
DS-9602 DS-9603	740	DS-9628
TU115 DS-9621	740	DS-9625

*Includes K-9254 Collar Clamp for upright cabinet cable entrance.

SERVICE SHOPS ON WHEELS

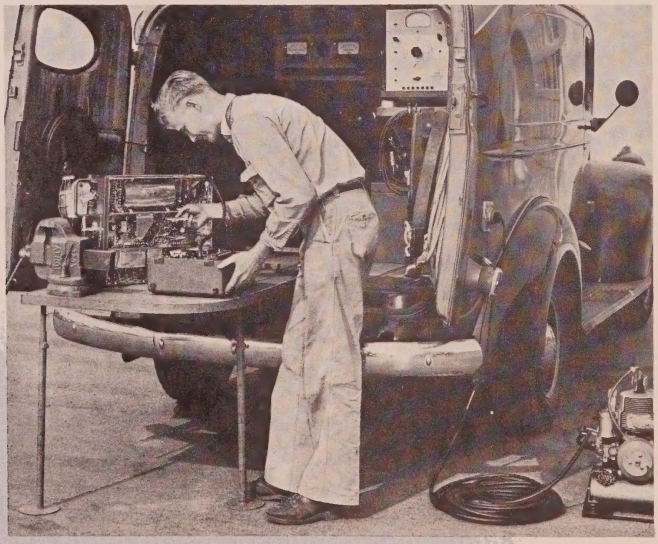
MOBILE MAINTENANCE SHOPS SPEED "ON-THE-SPOT" SERVICE

There are times and conditions when a 2-way radio service shop in a fixed location is not a fully adequate facility. Flexibility for "carry-out" or "take-to" service for base stations, remote control units, repeaters, etc., is often another outlet for MSS services. Under these circumstances, many Motorola Service Stations and Motorola customers have adapted vehicles to serve as mobile service stations, supplementing fixed shops. Data on several of these units is summarized in the following paragraphs.

TRUCKS

A popular and most useful truck for a mobile service station is the vehicle known as the "Package Delivery" truck, the "Vanette", the "Car-O-Van" or by some other trade name. The walk-in body has sufficient space to install a compact and efficient shop suitable for maintenance work in any location, day or night, summer or winter. A conventional panel truck can be adapted for the same service as a mobile shop but does not have the headroom for the full convenience of inside working facilities. Similarly, a station wagon could be used, subject to the same limitations as a panel truck. A number of larger governmental agencies (large cities, counties, states and federal organizations) employ a larger van or semi-trailer as a mobile communications center which also has space allocated for shop facilities.

Photo Courtesy Southern Counties Gas Co.



Mobile service shop of the Southern Counties Gas Company.

POWER

When the vehicle is equipped with a heavy duty generator or an alternator-rectifier set rather than the standard generator, and when the battery is adequate for the service, the vehicle electrical system will normally supply sufficient low voltage DC power for servicing mobile units in the shop. If the vehicle is equipped with a 12 volt electrical system, a converter such as the Motorola Model TA142 can be used to provide 6 volt power for the radio units.

To obtain AC voltage for test equipment, other facilities are required. One solution is the use of a small gasoline engine driven alternator. Rotary or vibrator converters could also be employed. Another very simple yet effective system is used by the Mobile Communications Company (Charles E. Holman) of Topeka, Kansas.

This unique system employs the AC output of the alternator of the alternator-rectifier battery charging set. Two 6 volt 20 ampere filament transformers are connected in parallel to the output terminal of one phase of the alternator. The primary (117

Exterior and interior of the mobile service station of the Mobile Communications Company of Topeka, Kansas.

volt) windings of the transformers then supply the AC voltage to the shop electrical system when the alternator is operated at a speed which produces a 60 cycle output voltage. In this particular installation, approximately 300 watts can be drawn from each phase of the alternator and it was found that 600 watts (two phases) was adequate to power test equipment, lights, soldering irons and other electrical devices in the shop. Full metering of all input and output power to and from the shop is included.

It is also advisable to use a long heavy duty extension cable to serve a dual purpose. When AC power is available nearby, the cable can be used to bring power into the shop electrical system. When the AC power is required at some distance from the truck in an isolated area, the same cable can be used to power lights, soldering irons, etc. from the shop electrical system when the work cannot be done in the shop.

CABLING

Flexible conduit or equivalent protection should be given all cables, particularly where they are routed under the vehicle. Switches and fuses or circuit breakers for power control and circuit protection should be conveniently located. All power outlets should be readily accessible and clearly labelled.

It is advantageous to have a patch board installed whereby any radio unit can be connected to the proper power, control and antenna circuits through jumpers and patch cords. A duplicate patch board in the driver's compartment may also add to versatility.

EQUIPMENT

The Topeka unit illustrated contains a ¾ size desk used as a work bench, plenty of drawers for small parts and lockers for larger parts and equipment. Well labelled, easily reached storage facilities such as these should be included in the plan. Another installation includes a file cabinet for service records, instruction manuals and other essential papers. All equipment should be fastened down and locks or latches provided on all cabinets so that the contents are not spilled whenever the truck rounds a sharp corner. The Topeka unit also includes a bulkhead between the driver's compartment and the shop, making the shop inaccessible even if the driver's doors are left unlocked.

The actual tools and test equipment included in the shop will, of course, be determined by the equipment serviced, the type of servicing contemplated, and the needs of the technician who will be doing the servicing. Construction of a mobile service station offers many opportunities to exercise ingenuity in the construction of built-in test facilities and homemade servicing circuits. Considering the space available, the practical economic limits and the need for specific pieces of equipment will determine the final amount of equipment included. Later expansion can be made if desired.

Above all, sound planning is essential in the construction and application of such vehicles. An efficient and economical plan can mean the difference between a shop which pays for itself and one which is only another financial burden.

TRANSMISSIONS . . . About Motorola 2-Way Radio Users

Phone Service Restored . . . . .

The West Coast Telephone Company recently completed installation of a Motorola microwave system to Guemes Island off the coast of the state of Washington. The microwave system, which furnishes communications between the island and Anacortes, restores telephone service to the islanders.

Guemes Island formerly received telephone service by a submarine cable laid from Anacortes to the island, but the cable was repeatedly damaged by ships dragging their anchors in the very heavy tidal currents that run through the channel.

Although the new microwave system is capable of handling 24 simultaneous conversations, it is presently equipped with only three channels but will be expanded to six channels in the near future.

According to G. M. Northington, district manager of the company, it is the first such system to be established for local exchange service by any telephone company.

The Payoff . . . . .

Police Chief Glenn Adams of La Mesa, California reports that his department's two "Handie-Talkie" radiophones proved their worth in one case alone recently.

The La Mesa Police Department had been troubled frequently by a series of thefts from cars parked in a bowling alley parking lot. In order to catch the culprits in the act, an officer was stationed on the bowling alley roof one night with a "Handie-Talkie" unit beside him.

Shortly after, he spotted the car prowlers at work and provided the dispatcher at police headquarters with a running account of the thieves—their description, their clothes and what they were taking from the vehicles.

Then via the "Handie-Talkie" unit he directed police units to all possible entrances to the parking lot, cutting off all escape routes. The entire gang was rounded up in an alibi-proof case.

The Cop's Best Friend . . . . .

As far as Patrolmen Joel Meadows and A. J. Alton of the Muskegon, Michigan Police Department are concerned, two-way radio is a good friend when you're in trouble.

Their patrol car bumped over a curb and crashed after leaking carbon monoxide fumes overcame Meadows, the driver. Just short of unconsciousness himself, Alton turned off the ignition, called for help over the radio and then collapsed.

Their fellow officers in other cruisers were quick to the scene. The unconscious Meadows and Alton were rushed to a nearby hospital where they were revived by oxygen and later released.

REGIONAL DIRECTORY

For your convenience, there is listed below a complete directory of Regional Managers for Motorola Communications and Electronics, Inc. together with their offices and territories covered.

REGION 1
HENRY C. GAMMELL
Arizona, California, Idaho, Montana, Nevada, Oregon, Washington, Wyoming, Utah.
Office: 811 South "B" Street
San Mateo, California
Phone: DIAMOND 4-6386

REGION 2
EUGENE F. BROWN
Colorado, Iowa, Kansas, Minnesota, Nebraska, North Dakota, South Dakota.
Office: 817 Kilpatrick Bldg.
Omaha, Nebraska
Phone: WEBSTER 0017

REGION 3
HOMER L. MARRS
Illinois, Indiana, Missouri, Wisconsin.
Office: 1327 W. Washington Blvd.
Chicago, Illinois
Phone: TAYLOR 9-2200

REGION 4
GLENN MUNRO
Kentucky, Michigan, Ohio, Tennessee.
Office: 19142 James Couzens Hwy.
Detroit 35, Michigan
Phone: UNIVERSITY 3-6464

REGION 5
EDWARD L. FALLS, JR.
Arkansas, Louisiana, New Mexico, Oklahoma, Texas.
Office: 171 Parkhouse Street
Dallas 7, Texas
Phone: STERLING 4951

REGION 6
HORACE E. BOYLAN
Alabama, Florida, Georgia, Mississippi, South Carolina.
Office: Stallings Bldg., Rm. 601
1829 First Ave., North
Birmingham, Alabama
Phone: 4-4582

REGION 7
JOHN F. FUSSELL
Delaware, Maryland, North Carolina, Virginia, Washington, D.C., West Virginia.
Office: 2309 Calvert St., N.W.
Washington 8, D. C.
Phone: ADAMS 4-5620

REGION 8
P. R. KENDALL
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont.
Office: 540 Main Street
Winchester, Mass.
Phone: 6-2482

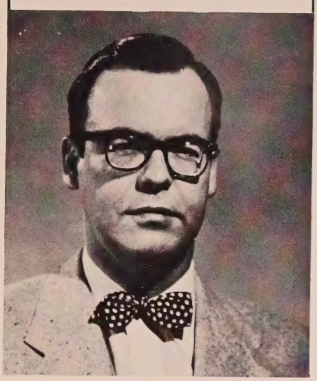
REGION 9
LOWELL E. WHITE
New Jersey, New York, Pennsylvania.
Office: 102 Linwood Plaza
Fort Lee, New Jersey
Phone: 8-9100

REGION 11
FRANK W. WALKER
Arizona, Southern California, Southern Nevada.
Office: Rooms 11 & 12
6047 Hollywood Blvd.
Hollywood, California
Phone: HOLLYWOOD 2-1378

WASHINGTON D. C. OFFICE
L. HARRISS ROBINSON
Federal Agencies

NATIONAL RAILROAD SALES
R. FLOYD McCALL
Office: 900 N. Kilbourn Ave.
Chicago 51, Illinois
Phone: SPAULDING 2-6500

PROMOTION



HAROLD A. JONES

Daniel E. Noble, Vice President in Charge of Motorola Communications and Electronics Division, has announced the promotion of Harold A. Jones to a general staff position as Executive Assistant to the National Sales Manager, Eugene S. Goebel. In this new capacity, he will administer the National Sales Office activities. He will retain his duties as Manager of the Technical Information Center which are concerned with public relations, sales promotion, and the MOTOROLA NEWSGRAM publication.

REPORT ON SALES SUBSIDIARY

National Sales Manager Eugene S. Goebel recently announced the results of an analysis of the operations of Motorola's year old, wholly owned sales subsidiary, Motorola Communications and Electronics, Inc. The analysis, made by top management of the parent company, Motorola, Inc., considered the policies of the young organization on five different aspects of its ability to serve the interests of its customers.

USER'S NEEDS

The executives felt that a company's communications requirements are best understood by its own personnel and cannot be delegated to an outside organization. Consequently, they fully agreed with the current policy of deferring decisions on all such matters to the user with full professional counsel available.

RADIO EQUIPMENT

Secondly, the group considered the customers ability to select specific units from the broad line of highly technical equipment available. They agreed that the assistance of a qualified engineer was in most cases essential and approved the company's present program of maintaining a staff of radio communications engineers for such a purpose in every area in the country.

MAINTENANCE

The third point discussed was maintenance. The conclusion reached was that a radio system should be maintained by the user's staff, by a qualified maintenance organization or by a combination of the two, depending upon the size of the system and the character of the operating organization. In answer to this problem, Motorola enters into maintenance agreements as prime contractor with any user of any type of radio communications equipment where desired.

FINANCING

The fourth point was the financing of the required communication service. Direct ownership was determined to be the lowest cost method of obtaining use of a radio system. Motorola can arrange for extended payment plans. Where the user prefers, Motorola will lease the equipment.

"RIGHT-OF-WAY"

On the subject of the user's continued right to use the allocated frequencies to his best advantage in conformity with FCC regulations, Motorola pledged itself to extend every effort to protect and insure that right in the future.

At the height of action, apparently unperturbed by the shots around them, Gene Goebel and Glenn Munro, Motorola Communications and Electronics, Inc., officials, were awarded field commissions as Kentucky Colonels at a party held in their honor on August 18 at the Campbell House in Lexington, Ky. The awards were presented by Warren Wright, Jr., president of Associated Dispatch Corporation, and Joseph C. Lewis, a Lexington attorney. The awarding Kentuckians also adjusted the ceremonial insignia of rank, Black String Ties, with unparalleled verve and dash.

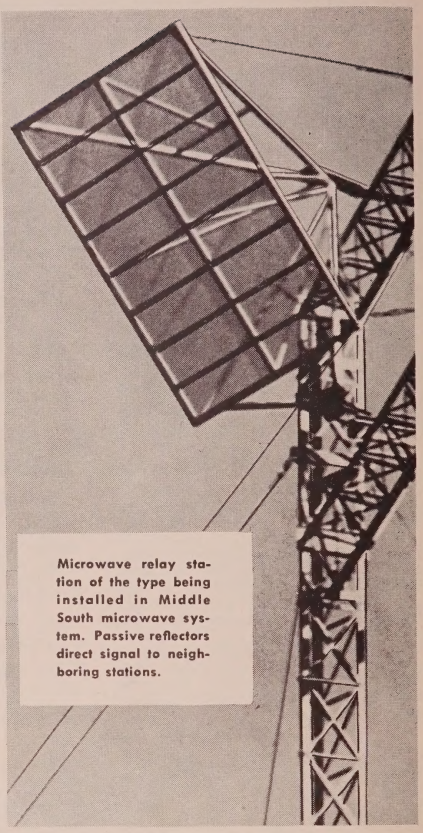
Left to right are Gene Goebel, Warren Wright, Jr., Glenn Munro and Joseph C. Lewis.

Middle South and Gulf States Utilities

CHOOSE Motorola for MICROWAVE SYSTEM

MIDDLE SOUTH UTILITIES MICROWAVE SYSTEM LEGEND

- ○ Louisiana Power & Light
- ✳ Gulf States Utilities
- △ Arkansas Power & Light
- □ Mississippi Power & Light
- ☆ New Orleans Public Service

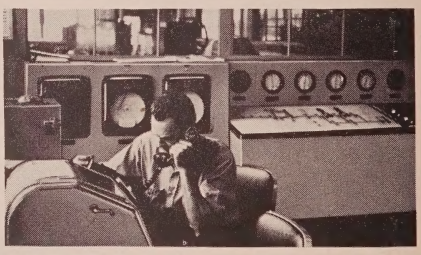


Microwave relay station of the type being installed in Middle South microwave system. Passive reflectors direct signal to neighboring stations.

Vast Motorola Network will assure continuity of service . . . adequate power . . . for Middle South consumers.

Motorola microwave will soon blanket Louisiana, Mississippi and Arkansas with one of the largest networks of its type in the world. 11,000 channel-miles, at the disposal of five Middle South Utilities, will speed supervision and control of power throughout the area.

Motorola Microwave enables your vital communication to keep pace with ever-increasing power systems. Job-proven Motorola microwave is first choice of industry across the nation. Discover now how it can help *you* cut costs and improve service.



Multi-Channel Utility—private line, party line, teletype, audio frequency carrier for telemetering, supervisory control and mobile radio.

Motorola Systems Are In and Working for These Companies

Below is a partial list of systems installed and operating, and those under construction (*).

Pacific Power and Light Co., Portland, Ore.
Brazos River Electric Transmission Cooperative, Waco, Tex.
Illinois Power Co., Decatur, Ill.
Central Illinois Public Service Co., Springfield, Ill.
Pan American Pipeline Co., Houston, Tex.
Shell Pipeline Co., Houston, Texas
Panhandle Eastern Pipeline Co., Kansas City, Kan.
Southern Counties Gas Co., Los Angeles, Calif.
La Fourche Telephone Co., Golden Meadow, La.
Mid-Valley Pipeline Co., Longview, Tex.
Greenwood Telephone Co., Greenwood, S. C.
*Bonneville Power Administration, Chehalis, Wash.
*Sinclair Pipeline Co., Independence, Kan.
Freeport Sulfur Co., New Orleans, La.
*West Coast Telephone Co., Everett, Wash.
*Dayton Power & Light Co., Dayton, O.
Southern California Edison Co., Los Angeles, Calif.
*Middle South Utilities, Pine Bluff, Ark.

—with many additional systems under construction

Job-Proven Microwave

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